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DOMINION OF CANADA  
DEPARTMENT OF RAILWAYS AND CANALS  
HIGHWAYS BRANCH

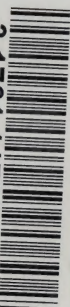
Bulletin No. 1

# CANADIAN HIGHWAYS AND ROADS



Ottawa  
F. A. ACLAND  
Printer to the King's Most Excellent Majesty  
1922

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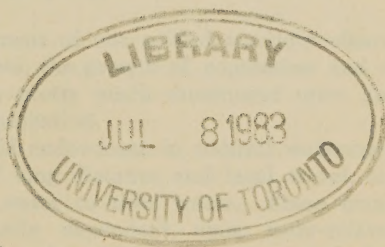


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# CANADIAN HIGHWAYS AND ROADS

## PREFATORY INTRODUCTION

Until quite recently, the locations, widths, drainage structures and surfacings of most public roads of Canada from sea to sea, have remained, subject to periodical repairs, what pioneering conditions could provide.

For reasons suggested herein, the importance of improved conditions of travel on the leading public highways and roads of the Dominion, is of national moment.

One of the chief objects of aid to highway improvement being contributed by the Federal Government of Canada, by virtue of the Canada Highways Act, 1919, is to secure uniform and modern methods and practice in such public work throughout the provinces. Familiarity with some road constructed according to scientific methods has raised the public estimate of what constitutes a "good" road, and has heightened the public appreciation of the service results from such methods.

The following pages are presented as a summary of experience, with roads good and bad, in the different provinces of the Dominion.

A. W. CAMPBELL,

*Chief Commissioner.*

## GENERAL INTRODUCTION

Canadian history pertaining to the development of our settled territory clearly indicates that the use of our natural resources, the growth of population and of industrial and commercial activities have been pretty much consequent upon and according to the means provided for inter-communication.

Railways and canals, together with a splendid endowment in natural waterways, now serve to unify, by providing easy means of long distance and local travel, the varying interests of the Dominion, from tidal water to tidal water. These trunk facilities of transportation are, however, primarily dependent upon inter-related networks of common highways. Since and prior to the construction at great capital cost of great systems of railways in Canada, the one fundamental and essential means of internal transit has been the common road. In fact, a pre-requisite to the successful operation of trunk railways, is numerous contributory systems of good highways.

The common road is that part of any system of inter-communication that comes most closely to all citizens, every day of the year. Inland, away from large centres of population, the public road is generally the sole means of getting about. Hence of the trinity, railways, waterways and highways, the latter are not only primary, but having regard to their bearing on the general interests, perhaps the most important avenues of travel in a country.



An analogy between the transportation system of a nation and the circulatory system of the human frame suggests the importance of the numerous small auxiliaries, in the wellbeing of the whole organization. In regarding the highways of the Dominion as the arteries of its economic life, and the common roads and trails as the arterioles or little arteries, all functioning to supply each remote division with its requirements, a similarity of function is evident. There is a constant regular distribution and collection of elements that must be exchanged with a minimum of friction if health is to be maintained in either organization.

In a nation, from different centres of many-chambered supply there are going forth daily articles of every description, in carts, buggies, wagons, motor vehicles, lorries, vans, and railway cars, over the roads of earth, stone, bitumen, concrete, and steel. But the various roads trunk and branch, of this country function not alone as arterial systems, but also as venous systems. They are required to sustain a two-way traffic. They are a means of collection as well as distribution. And therefore, the extent that bad roads prevent the regular forwarding of supplies from outlying sections to cities and towns, is also a measure of the economic health of the nation. While the various country districts should be given every facility to assimilate and absorb as much as possible of the material and intellectual resources of urban centres, the latter are also entitled to receive as cheaply and regularly as possible their own requirements of fresh natural products. It follows that in building or in encouraging the building of good roads, the responsible authorities are helping to vitalize and energize the natural processes of development and of civilization in the country.

Any measure tending to abridge distance is a marked step in advance. As an improved road and an automotive vehicle reduce the time of travel, there has been during the past ten years a renaissance of highway transport, both for pleasure and business. The general adoption of the self-propelled road vehicle is the complementary factor in the general desire for general betterment of road conditions in Canada.

Wherever one may travel in Canada, the automobile will be found. In the Yukon District, eighty owners register annually; while in the most southern portion of Canada, Pelee Island, a small island in Lake Erie, ten miles off shore, sixty are counted. Hence, this vehicle has given an importance to the condition of the common roads of the country that is appreciated in part, only by the individual owner. With a total registration in the Dominion approximating a half million owners, of automotive vehicles, the necessity of wide improvement of the leading roads of the country is being generally recognized. And the wisdom of framing policies of highway development, having regard to the momentous change in the last few years in the character and amount of traffic now using our roads, is being considered.

Figures supplied by the different Provincial Departments of Highways indicate that in 1920, about ninety-three per cent of the 447,384 miles of roads open to public travel in the Dominion were still without road metal of any kind. While many of the unsurfaced roads are quite good in dry weather, dissatisfaction in most sections of Canada, with conditions for automotive traffic, particularly, is tempered only by a realization that the task and cost of general road improvement is too great to be overtaken and handled in a few years. The policy of substituting base-course roads where the surfaces cannot well be provided immediately for the pre-motor roads is now in general favour.

The urgency of the matter is that bad roads injure pneumatic automotive equipment perhaps as much as this traffic injures the roads that used to pass as improved. Owners of high-class costly road vehicles object with reason to road taxes in the form of wrack and strain, leading to repair bills, caused by bad road conditions. Accord-

ingly, service to the travelling public, as well as a reasonable protection of the public investments in road construction, demand as hard and durable a construction as possible, followed by methodical maintenance.

Enterprise in building improved highways invites and generally arouses enterprise in every citizen who may have occasion to use them. In no respect will a comparatively unimportant ripple of public enterprise develop so effectively into a composite wave of individual enterprise, reacting in various directions, as that of improving poor roads. Such improvements react not alone upon the actual travellers on the roads, but also upon the public spirit of whole communities.

No attempt to appraise and sum the benefits to be derived from good roads can overlook the more or less indirect and intangible results accruing to a country, as a consequence of a general programme of highway improvement.

Any presentation of the more concrete advantages and gains to the nation, the community and the individual, from good roads, should treat of the drawbacks and losses entailed by bad roads. With the latter, at all events, every traveller is more or less familiar. Hence such a treatise must necessarily embrace trite topics. In fact, the necessity for reform in conditions of highway transport in Canada is rather generally recognized.



## CANADIAN HIGHWAYS AND ROADS

Before considering the subject analytically, a general classification of the results from roads as they are, and as they might be, follows:—

### A.—FINANCIAL

1. Bad roads add to, and good roads lower costs of hauling.
2. Bad roads restrict choices of place and time of marketing, and good roads widen ranges of distribution.
3. Bad roads circumscribe and good roads increase areas that may be devoted to the production of high priced products.
4. Bad roads lower, and good roads increase the values of lands and property everywhere.
5. Bad roads increase costs of operating vehicles; better roads mean cheaper vehicles.

### B.—SOCIAL

6. Bad roads limit, and good roads help the growth of rural population.
7. Bad roads retard, and good roads make possible the development of rural mail delivery service.
8. Bad roads affect school attendances, and good roads foster efficient educational administration.
9. Bad roads breed the peculiarities and social weaknesses created by isolation, and good roads make for better morality, and for better general social conditions.
10. Bad roads intensify racial differences, and good roads facilitate and promote mutual understanding and union.
11. Bad roads create serious menaces to health, and render difficult the care of the sick; while good roads minimize the dust nuisance, and enable the medical and nursing professions to extend their fields of operations.

### C.—NATIONAL AND GENERAL

12. Bad roads keep out of the country foreign pleasure and health seekers, and good roads induce foreign tourists to motor in large numbers through different parts.
13. Bad roads prevent the expansion of the automotive industry, while good roads lead to growth of capital and labour required in the production, sales, accessory supply, and repair of motor vehicles.
14. Road conditions affect the amount of energy, both physical and mental, required of drivers of all kinds of vehicles, and bear on the number of accidents on the roads.
15. Bad roads lower the value of each citizen to the country as a whole; while good roads promote a better, broader-based citizenship.

The topics suggested above will now be considered one by one, in more detail.



## 1. Cost of Hauling.

With a view to making a study of the economic losses due to bad roads, the Highways Branch of the Department of Railways and Canals made arrangements with the Dominion Bureau of Statistics in December, 1919, to collect from its crop correspondents statistical information as to the cost of haulage of crops and other products over the unimproved and the improved roads. The questionnaire asked for the following information:—

1. What is the average length of haul from farm to market or shipping point in your district?

NOTE.—The correspondent will have regard to the farmer who draws his produce the greatest distance and to the farmer who lives close to the market, and then take a fair average.

2. What is the prevailing crop or product grown in your district?

NOTE.—Examples of the answer desired are "Wheat," "Live Stock," "Apples," etc.

3. What is the average load of such product with a team of horses?

NOTE.—A simple calculation will be necessary to express as tons, units of measures such as bushels of wheat, bushels or oats, or barrels of apples.

4. What is the average cost of hauling one load with a team to the market or shipping point?

NOTE.—The necessary calculation is easily made from the prevailing wage of a driver and team and the time consumed in the loading or unloading covering one way.

5. What is the prevailing type of road in your district?

NOTE.—Examples of the answer desired are: "Ordinary dirt," "Improved dirt," "Gravel," "Macadam."

6. Are there any unusual features relating to the type of road in your district affecting cost of haulage?

NOTE.—Examples of the answers desired are: "Excessive grades" and "Prolonged seasons of rainfall."

The following summary compiled from the 892 replies received permits of different interesting comparisons with respect to varying costs of hauling per ton per mile, of weight of loads and of distance to market centres in the different provinces:—

**AVERAGE WEIGHT OF LOAD, DISTANCE, AND COST PER TON-MILE OVER ROADS  
IN CANADA, BY PROVINCES, 1919.**

Province	Ordinary Dirt				Improved Dirt			
	Replies	Weight of Load	Dis- tance	Cost per ton mile	Replies	Weight of Load	Dis- tance	Cost per ton mile
	No.	Ton	Miles	Cents	No.	Ton	Miles	Cents
Prince Edward Island.....	37	1.2	5.2	43				
Nova Scotia.....	104	1.25	8.0	39	35	1.25	7.5	39
New Brunswick.....	44	1.3	7.2	44	22	1.3	5.6	43
Quebec.....	167	1.2	7.3	46	100	1.4	7.8	37
Ontario South.....	148	1.4	7.2	42	155	1.4	6.55	41
Ontario North.....	26	1.1	8.0	52	22	1.4	7.8	44
Manitoba.....	163	1.7	7.1	37	101	1.9	5.5	33
Saskatchewan.....	125	1.75	10.1	30	69	1.9	8.1	29
Alberta.....	68	1.8	11.9	29	42	1.75	11.2	29
British Columbia.....	9	1.3	5.0	80	12	1.3	4.1	68
Canada.....	892	1.5	8.0	37	558	1.6	7.1	35
	Gravel				Macadam			
	Replies	Weight of Load	Dis- tance	Cost per ton mile	Replies	Weight of Load	Dis- tance	Cost per ton mile
	No.	Ton	Miles	Cents	No.	Ton	Miles	Cents
Prince Edward Island.....								
Nova Scotia.....	11	1.5	7.1	34				
New Brunswick.....	4	1.25	8.5	26				
Quebec.....	50	1.6	8.7	27	29	1.9	9.8	24
Ontario South.....	213	1.6	6.25	38	26	1.7	9.5	26
Ontario North.....	13	1.7	10.9	32				
Manitoba.....	9	1.9	6.7	27				
Saskatchewan.....								
Alberta.....								
British Columbia.....	9	1.75	3.1	54				
Canada.....	309	1.6	6.8	34	55	1.8	9.5	25

An explanation of the surprisingly low cost per ton-mile of hauling in the Prairie Provinces over unimproved roads is the much greater average distance of haul, than is necessary in the east. The same amount of time is required in preparation for a trip however long the haul, and this must be included in the cost.

The average cost per ton-mile of hauling over unimproved dirt or earth roads was found to be 37 cents, over the improved dirt roads 35 cents, over gravel roads 34 cents, and over macadam roads 25 cents. It will therefore appear that if, for instance, an improved dirt road over which the cost of hauling per ton-mile is thus shown to be 37 cents is to be graded, and given a macadam surface, the gain to the users of every mile of the road so improved will amount for each ton carried, over each mile, to 12 cents, or  $32\frac{1}{2}$  per cent.

Most of the hauling of the crops in Canada is done at seasons of the year when the roads are best; hence the cost per ton-mile of hauling over unimproved roads is the lowest possible rate during the year. Still the extent to which the individual farmer is affected by high hauling costs may be seen from a single illustration.

Supposing a farmer marketed during the season 10,000 bushels of wheat, in a town ten miles from home. His product as marketed, expressed in ton-miles, is 3,000. Consequently if the road now unimproved which he follows from his gate to the elevator were macadamized, his saving during the season would amount to 3,000 times 12 cents, or \$360.

The prodigious losses annually through poor highway transport facilities to the different agricultural sections of this country, and the possible gains from improvement of roads generally may be seen from another calculation. The Dominion Bureau



of Statistics reported that the total yield of wheat in Canada for the year 1920 was 263,189,300 bushels, or 7,895,679 tons, and that the total yield of oats for that year amounted to 530,709,700 bushels, or 9,022,064 tons. The total yield of these two grains alone in 1920 amounted to 16,917,743 tons. Now the average distance of haul is found by the questionnaire to be 7.6 miles. Assuming that all of this tonnage is marketed in some form, the total ton-mileage for these grains amounted to 128,574,846. The difference between hauling over unimproved and the improved road is 4 cents per ton-mile. Consequently for this total ton-mileage, the possible saving to be effected by improving to the standard of the ordinary earth road, all the roads in the country used by agriculturists was \$5,142,933.87 in 1920.

Similar calculations might be made with respect to metalled roads, with respect to other crops, or to mercantile tonnage travelling from market centres to every nook and corner of the Dominion.

With regard to the average tonnage per load over the different types of market roads dealt with, the replies show that the greatest loads averaging 1.9 tons in each case were drawn over the macadam roads of Quebec, the improved and gravel roads of Manitoba and the improved dirt roads of Saskatchewan. A number of the correspondents stated that over macadam roads a load of two tons was customary, but that greater loads might be drawn with less strain than is required in hauling much smaller loads over unimproved roads.

The relatively high cost of hauling per ton-mile in British Columbia is due of course to the high grades ruling in that province. The cost of hauling over gravel roads for example is twice as high in British Columbia as in New Brunswick or Manitoba. It is therefore evident that the extent that road resistances can be overcome for hauling purposes, by reductions of excessive grades, consistent with the amount of traffic to be accommodated, will determine the total cost of transportation, and the ultimate costs to consumers of natural products hauled over such roads.

## 2. Choice of Place and Time to Market.

According to the returns from the crop correspondents, the provinces having the longest average length of haul are Alberta, the northern part of Ontario, and Saskatchewan, with respective mileages of 11.9 miles over ordinary dirt, 10.9 miles over gravel and 10.1 miles over ordinary dirt roads. However, according to type of construction, macadam gives the longest average haul, being about 9½ miles.

It is clear that macadam roads permit of wider choices of market centres, for the same amount of time and energy than do unimproved roads. When a farmer is surrounded by unimproved roads, even though he can get a better price and buy to better advantage in the town say fifteen miles away than he can in the village say five miles away, he is often compelled to sell in the village market. The bad roads to be found about numberless communities in Canada cause producers time and again to sell their products and to buy supplies in the nearest market, even though they know they are losing money on both transactions.

Agriculturists are becoming watchful of market fluctuations with a view to selling their crops when the prices are at the highest. Newspapers, mail quotations, and even radio-phone reports are being sought eagerly by some classes of producers. These men it is evident have a distinct advantage, providing the right time to sell is in no way conditioned by the state of the roads which they will have to use.

### 3. Intensive Cultivation over Wider Areas.

Any measure that will encourage generally a more intensive cultivation of the soil is worthy of public support, because experience shows that Canadian farmers are somewhat prodigal of their potentially productive resources. Good roads not only increase areas which may be used for producing the more perishable, high-priced products, but also encourage diversification of crops.

Land in the outskirts of urban centres usually commands a higher price than land remote from such centres, and one of the principal reasons for this economic fact is that land close in may be used to produce garden stuff, fruit, or dairy products. The areas contributing to the milk supply of large centres are dependent quite directly upon the possible facilities of transport; and the same is true though to lesser degree of many other products in demand in cities. Stated in another way, good roads mean that farmers theretofore remote from centres of consumption may profitably engage in the production of high-priced grains and foodstuffs; and consequently their properties increase in value.

Intensive cultivation of land leads to a greater range in the type of goods produced, and the land itself becomes richer and more productive as a result.

Good roads are the friend of the small farmer in another way. With his limited means, help and equipment, the amount of field work done per day is limited. If the small farmer can do his hauling more quickly and more efficiently, his help and equipment can be devoted to general farm duties for greater periods of the week. Then if the roads are not affected appreciably by weather conditions he can do his hauling during rainy periods when he cannot go out into the fields.

### 4. Road Conditions and Land Values.

Not only do good roads cause the values of farm property to rise because urban centres are brought comparatively nearer to farm owners, but also because the dwellers in towns and cities are enabled to reach easily country homes. Property situated immediately along the route of a modern improved highway often increases from 50 to 300 per cent, for the reason that it becomes attractive to residents of a city. Many farms along the cement concrete highway between Toronto and Hamilton have passed hands of late years at rates that before this main trunk highway was constructed would have been regarded as exorbitant. Nowadays, however, with automotive service from office door to home gates, a 10, 15, or 20 mile drive night and morning is quite pleasurable over such thoroughfares. Many of the farms referred to, prior to being taken over by their present owners were unproductive, as, in some cases, the soil was heavy and required drainage and under-tiling, and, in others, fertilization measures. To-day these same farms are producing excellent small fruits, and all the high-priced commodities a well cared for farm is capable of. The same effects from modern highway construction on rural and semi-rural roads are even now in evidence in different districts in Canada.

### 5. The Condition of the Road in Relation of Motor Vehicles.

On account of the accumulative wearing and straining effects upon their motor vehicles, of unpaved roads, some owners in urban centres will not drive beyond paved streets and roads. The economically efficient life of motor vehicles bears a definite relation to the character of the road surfaces traversed. Some of the effects of bad roads upon motor vehicles are ably set out in the following quotation from *Engineering*, London, Eng.:—



"There are four principal effects of bad roads as reflected in the wear and tear of motor vehicles. There is, firstly, the crystallization and fatigue produced in all metal structures by constant shocks and vibration as, for instance, by pot-holes, corrugations, uneven stone setts, and other irregular surfaces. There is a definite and ascertainable deterioration of the metallic structure in axles, axle-casings, frame, cardan shaft, steering gear, and other parts of the vehicle specially subject to the road vibration. Most of the shocks, although individually of very short duration as a rule, are at the same time of great intensity in some cases. For instance, an ordinary three-ton motor lorry, weighing with its load about  $7\frac{1}{2}$  tons, at 15 m.p.h.—a very ordinary speed—has often to run through pot-holes sometimes as much as 2 inches deep or over corrugations whose wave lengths, if the expression may be used, from the highest and lowest points are generally 9 inches to 12 inches apart. On modern roads there is an almost unyielding surface on the far side of these obstructions or holes for the wheel to strike. The blow at the point of the impact is often in force, as much as three times the weight of the vehicle, and in quite ordinary cases equal to one and a half to twice its weight, or in the case of the 3-ton load vehicle mentioned an impact shock of 15 tons to 30 tons. This blow and shock has to be taken up first by the tire generally in the case of commercial vehicles made of solid rubber, which unfortunately, after a good deal of use, loses a large proportion of its natural resilience. After the tire and wheel come the springs, comparatively stiff in character in the case of a commercial vehicle, which are compressed and relaxed quickly and constantly. Next in order to share in the shock comes the frame, and eventually the transmission-gear, the engine-bed and engine itself.

"In the second place, there is the definite wearing of certain movable parts, which themselves have to move with shocks or vibrations, such as the leaves of the springs, the spring shackles and bolts, and wheel brake bands and brake connections. Again, the various rods and the worm-gear connecting the front wheels with the steering gear are in a state of constant movement. In the case of a heavily-laden vehicle, the spring shackles and bolts, unless they are carefully lubricated, show much wear in a short space of time, and when they become worn and loose in their fittings, not only is their wear accentuated, but a disagreeable chattering and noise is set up which, in fact, forms a great part of the noise nuisance which has lately become so serious in the case of heavy commercial vehicles. The body work is also strained and shaken over a bad road, and the fitting of doors, windows, and tailboards affected.

"In the third place a considerable amount of extra power is necessary to propel a vehicle of equal weight and encountering wind resistance at the same speed over a bad road as compared with a good road. The extra power expended is due to the fact that the vehicle and its wheels have to be raised continually many inches or fractions of an inch after falling into every depression; in addition, side lurches produce unequal strains and wear the differential gears. Every form of vibration and uneven motion increases frictional resistance, which is again reflected in the consumption of motor spirit. From tests the author made, in the engine and gears, some time ago with a lorry carrying three tons, he is of the opinion that under bad conditions, such as on an uneven and muddy road, the consumption of motor spirit is increased by at least 50 per cent compared with a good hard, smooth road. On a road full of pot-holes and corrugations, but with a hard, dry surface, the increase in consumption varies from 25 per cent to 30 per cent. Besides the actual expenditure of energy involved by the continual raising of the vehicle, after its fall

into pot-holes and hollows, the transmission of power from the engine to the road wheels is interfered with and proceeds in a jerky fashion, which is a contributory cause of diminished efficiency.

"Fourthly, in the case of bad roads where the wheel is constantly interrupted in its actual contact with the road surface for fractions of a second owing to bumps and subsequent hollows, there is much extra wear and tear on tires, on account of the tendency to sudden acceleration and deceleration in the rotation of the wheel, driven, as it is nowadays, by considerable engine power. This sequence takes place on every occasion when the wheel is not actually in close touch with the road surface. Again, the blow given to the tread and fabric of the tires by uneven surfaces tend to make them wear out much more quickly, in the case of both solid and pneumatic tires. In the case of solid rubber tires the resilience of the rubber is gradually destroyed. Though pneumatic tires undoubtedly damp down and neutralize small vibrations, and minimize to some extent larger vibrations, a really bad road causes severe strains on the rims, walls, and general fabric of these, and on the air-valves and security bolts, especially if there is any attempt to run at high speeds. Every blow also increases momentarily the internal air-pressure, though the exact increases of pressure are difficult to ascertain or express mathematically. But the author leaves it to the imagination as to what the strain on a pneumatic or solid tire must be when a heavy vehicle, at considerable speed, encounters a succession of blows caused by obstacles, such as the far sides of pot-holes or corrugations in the road. The momentum of the vehicle, calculated in the usual way by multiplying the speed by the weight, is every time checked at the cost of shock and vibration. Probably the pressures in a pneumatic tire rise for a second or fraction of a second to double or even treble their proper or usual amount, and it is conceivable that many of the bursts in the walls of fabric tires and the loosening or bursting of cords in the case of cord tires occur when these blows are delivered. In the case of solid tires the wheel of the vehicle strikes with greater force than with a pneumatic tire against any opposing surfaces, and the tires in this case tend to split longitudinally or are sometimes partially wrenched from the rims.

"In addition to these purely mechanical effects of bad roads, there is the considerable extra strain put upon the attention and endurance of drivers of vehicles, as there is a greater tendency to accidents observable in the direction of side-slips, skidding round corners, and failure of steering gear.

"From the foregoing instances of how depreciation is occasioned to vehicles by bad roads, it is clear that well made and smooth roads are of great value to road-users. The direct interest, therefore, of the user of mechanical road transport in the construction and maintenance of good roads is very considerable, especially in a commercial sense.

"If in various countries the taxes for road improvement placed on motor vehicles were even heavier than they are to-day, the payers of those taxes would recoup themselves many times over in the consequent saving, were the roads they use put into good condition, and vehicles enabled to run over comparatively smooth surfaces instead of over uneven and rough surfaces which are now only too common."

Motor vehicles will doubtless become generally lower in prices when standardization of designs, weight and parts shall have been achieved. Such a desirable object, however, will be impossible until there have been constructed long mileages of roads of a fairly uniform type. The economies that have been effected as a result of standardization in various industrial products, such as wagons, suggest the importance of removal of conditions prejudicial to this object.



## 6. Roads Affecting Increase or Decrease of Population in Rural Canada.

There can be little doubt that it is the dreary monotony necessitated by the lack of easy means of ingress and egress to and from homesteads and farm property generally, and the consequent isolation, and lack of contact with people and events, that cause the strong disinclination of experienced old country farmers to undergo the hardships necessary in new districts in Canada. Real estate dealers testify to the difficulty of effecting sales of farm property that cannot be easily reached.

There are unfortunately in almost every province of the Dominion many abandoned farms; and were the history of the sometime owners, and their motives open to examination, the cause in many cases would be lack of roads. Sometimes life in a town where living is dear is preferred to life on a farm where living is cheap but with little variety. Not only immigrants, but many native Canadians also succumb to the temptation to leave the slow but safe means of living to be had on isolated farm property, and enter the keenly competitive ranks of labour in urban centres for the sake of new associations and scenes.

The effect on population in the rural districts of the lack of roads is indicated by the following extracted from a daily paper published in a provincial capital, in the spring of 1922:—

“Sixty-eight families engaged in bona fide farming in the ——— district threaten to abandon the result of their pioneering work in that rich agricultural district north of ——— river, unless the present ——— highway is extended into the district, a deputation which met here this morning asserted. Five hundred families each settled on forty acres of the best agricultural land in the province would be made possible by the construction of the necessary link in the highway, the delegation asserts. Settlers will not go into the district on account of the lack of roads, and those who have already established homes there will get out, if they cannot get an outlet, Mr. ——— asserted.”

This tendency towards aggregations of experienced farm labour away from the place where it should be employed can be counteracted in part at least by the building of reasonably good roads, and then subsidizing if necessary the establishment of inter-communal lines of motor-buses. The day of the rural motor express is here. Unfortunately there is not enough business in sight in many cases to warrant an enterprising motor livery to provide scheduled service along main trunk roads. But if municipal councils were to lend their encouragement, by offering perhaps a small subsidy to proprietors of motor-buses, a great advance would be made in giving rural people a transportation service that would be greatly appreciated.

For some years the Natural Resources Branch of the Department of the Interior has been endeavouring to locate and list land in the Prairie Provinces that is being held out of cultivation, for any reason, with a view to having such lands brought under crop. It has been found that the interest of prospective purchasers of all this land depended quite generally upon the accessibility to the property so listed. Consequently, in order to learn some first hand facts regarding the roads or lack of roads in the districts which are yet comparatively unsettled, a questionnaire asking for information as to the location and mileages of all roads within the bounds of each municipality of the southern portions of Saskatchewan and Alberta was sent to the municipal councillors. Extracts from replies received by the Natural Resources Branch indicate that bad roads have been responsible in a number of cases for the exodus of former settlers, for poor school attendances, and for drab-coloured dreary

prospects for the future, until better facilities of transport are provided, as may be seen from the following:—

“South of our municipality, there never has been a dollar spent on road work. There were quite a large settlement in 1 and 2, 8, West ———. They have practically all moved away, as they had 40 to 50 miles to market, and over so much rough trail and hardships. They claim it was slow murder on them. I am sure if we could spend more time on our land instead of on trails, with such expense as we are having, we could compete with most other rural districts, that have their railways.—H. F.

“Water and bad roads are sure against the settlers in this part, as they do not get a chance to get even enough returns off their land to be able to pay their taxes, so that we as councillors could do something towards making roads for them.

“We have a school, the road to which is now impassable for the children to go to school. According to the law we have to build the school on a place which, on account of the sloughs and bad roads, is practically an island.—Wm. H. B.

“The roads marked are mostly clay and slough, and are in very bad shape, almost impossible to get through them in the spring when the frost comes out. The roads are the whole drawback to this country, as it is impossible to get or take a load to town, except on snow. This is a good mixed farming part of the country, but people don't want to take it up, because what they grow, they can't get out.—Chas. T.”

It thus appears that good roads are everywhere the lode stones of prosperity for would-be agriculturists. The formula may be expressed as follows: Roads permit excursive penetrations, then small aggregations, and commercial associations, these permit social organizations, and then individual and co-operative aggrandizement.

## 7. Roads and the Postal Services.

The approximate mileages of Stage Routes covered by His Majesty's mail couriers in each of the provinces are as follows:—

Province	Mileage
Alberta.. . . .	9,950
British Columbia.. . . .	8,140
Manitoba.. . . .	3,100
New Brunswick.. . . .	2,470
Nova Scotia.. . . .	6,360
Ontario.. . . .	4,574
Prince Edward Island.. . . .	22
Quebec.. . . .	5,820
Saskatchewan.. . . .	8,300
Total.. . . .	48,736



The approximate mileages of rural mail delivery routes in operation in the Dominion of Canada, by provinces, are as follows:—

Province	Mileage
Alberta.. . . .	3,959
British Columbia.. . . .	1,509
Manitoba.. . . .	2,696
New Brunswick.. . . .	4,855
Nova Scotia.. . . .	2,747
Ontario.. . . .	38,486
Prince Edward Island.. . . .	2,926
Quebec.. . . .	15,362
Saskatchewan.. . . .	2,049
Total.. . . .	74,589

It is estimated that the number of miles of the above covered by more than one courier, and duplicated by couriers in returning, would be ten per cent of the total. Hence approximately 110,000 miles of public roads in the various provinces are traversed regularly by postal servants of the Crown.

The effects of bad roads in limiting the efficiency of postal services, and the value of improved roads as affecting speed and regularity of deliveries are shown by extracts from statements of experiences of Canadian postal officials in this regard below:—

“The speed and regularity of rural mail delivery service depend almost entirely on the condition of the roads over which the service is performed; and as the condition of any road is improved the speed and regularity of rural delivery service over that road is affected accordingly; and the delivery service is affected adversely when the roads over which the service is performed are not maintained in satisfactory condition. For example the service over the ——— Rural Route No. 1, a distance of 39½ miles, is performed with commendable regularity, and the trip takes not more than 4 hours to perform, which time does not vary more than twenty minutes throughout the year. This regularity and speed is possible only under the most favourable road conditions, as the road over which this service is performed, is a hard surfaced one which is maintained in good condition at all times.

“In contrast to the above, the trip over ——— Rural Route No. 1, a distance of 42 miles, requires about 9 hours to perform, under favourable conditions, while during inclement weather, the contractor is unable at times to complete the trip in less than 12 hours, and as a result it is impossible to maintain a regular service on this particular route.

“Other services in this district which are governed entirely by the condition of the road might be referred to, but it is obvious that improved roads are indispensable to the speed and regularity with which rural mail delivery service is performed.”

Another postal official advises:—

“From actual experience, I have found that efficient service, on Rural Routes absolutely depends on good roads, and that in my capacity as field officer, 90 per cent of the complaints and irregularities I investigated could be traced back to a primary cause of bad roads.

“One great benefit derived therefrom (improved roads) being the fact that they bring the boxes into a straight line and thereby shorten the distance between them.

"The value of improved roads is also very apparent in the use of motor cars which can run in some sections practically the year round, as is the case between Winnipeg and ———, on a well graded and improved highway; and the delivery by motor-car is naturally much more rapid and more regular than when horses are employed."

An officer in a Maritime Province considers:—

"Good roads are like everything else that is really good, they are a blessing to all that come within the scope of their influence."

A postal official from the province of Quebec states:—

"From actual experience, improved roads are synonymous of speed and regularity in the performance of rural mail delivery service. As a matter of fact, it has been observed on several occasions that where the roads have not been improved, rural mail delivery service has to be temporarily discontinued during rainy weather, and especially in the spring and fall seasons. Therefore it may be stated that improved roads are of paramount importance, not only in respect of efficiency and regularity but also from an economical point of view, as the conditions of the road materially affect the cost of the service."

That many would-be patrons have had their hopes of the establishment of a new Rural Route deferred until their roads have been so improved as to warrant the necessary cost of such postal service, are matters of frequent, though not surprising record.

## 8. Roads and Rural Educational Facilities.

In every province of the Dominion there are thousands of one-roomed schools, with but a few pupils in each. Educationists are agreed that the work of educating young Canadians would be promoted if several of these small schools could be united into one large school. For good work, every school should have, according to an authority, two rooms, two teachers, and from thirty to forty pupils. Such schools cannot be established within walking distances of each other, in the country, except where some form of consolidation has been effected.

The consolidated school movement has made considerable progress in the province of Manitoba. According to a report of the Department of Education of Manitoba, published in 1913, on "Consolidation of Rural Schools", the advantages of consolidation are: (1) better school plants; (2) better attendance; (3) better teachers; (4) better school work; (5) the consolidated school is an all-year school; (6) transportation; (7) better civic-social opportunities; and (8) the consolidated school, a continuation school.

An axiom quoted in the report referred to is: "Transportation is the problem of rural life." Transportation of pupils by vans is the means that have given to many students of Manitoba a more attractive school life, with all the advantages of city schools. Grading according to abilities and aptitudes, and adopting full school curriculums are only possible in the country where the consolidated organization takes place.

That consolidated school organization has not taken place more generally in Manitoba, as well as in the eastern provinces is undoubtedly due to the bad roads in some school sections. Transportation over bad roads is costly; but how costly the lack of transportation may be educationally is sometimes not known until after going



without the consolidated school for a time, and then experiencing its benefits. In this connection the following extract from a report of a trustee of a Manitoba Consolidated School is significant:—

“I heard a comparison a day or two since by one who was at first opposed to the scheme. His words, as near as I can remember were: ‘The old rural school is to the new scheme as an old Red River cart is to an up-to-date auto. Not knowing a Red River cart except by hearsay, I presume the rural school and cart both answered their purpose in their day.’”

Wherever transportation of pupils is supplied school attendance increases, particularly in bad weather. And one of the effects of consolidation of school districts is often a movement for better roads, in order that the trip may be covered more expeditiously and with greater comfort. As roads take on more finished surfaces, motor-buses in place of the covered vans and horses may be expected to be used. One motor-bus can cover easily the territory that was formerly covered by two van drivers.

The importance of good roads to rural communities is in no respect greater than in regard to their place in a modern educational system.

## 9. Good Roads and Improved Social and Moral Conditions.

The effects of isolation created by natural barriers are known to many countries. That isolation from the more settled districts of a country leads to degeneration and breeds peculiarities distinctive of the locality is the testimony of all world-travellers. The peasants of the Lotschen Valley, Switzerland, speak a language of their own, and preserve their ancient customs which remain unchanged by intercourse with the modern world, owing to the barriers formed by the peaks of the Alps. Many parts of Canada have miniature Lotchen Valleys as far as the means the inhabitants have of meeting and learning from other citizens, or to form co-operative and social clubs, or to attend any form of social organization.

In the average community, perhaps the greatest social influence, after the public school, is the church. Attendance at religious services usually fluctuates as the road barometer reads “fine” or “muddy.” The extent that the effectiveness of different branches of the country church is dependent upon the conditions of the country roads is beyond appraisal; and where rural churches fail a leading cause is generally bad roads. The rural church problem is partially solved where improved roads have been built.

Where roads have been improved with hard surfaces, permitting the use of automotive equipment regardless of weather conditions, it is the experience of many churches to find greater interest in the various religious and social activities under their auspices. It is a fair deduction that good roads are to the churches what the churches are to the moral and philanthropic standing of any community.

Again the opportunity to enjoy fully the purely social pleasures of rural life tends strongly towards the keeping of young people contented with the life of a farming community. The extent that improved roads help to lift the average experience on the farm from the humdrum plane of existence is one important measure of their value. The statement will hardly be questioned that young people will not be drawn away from the farm to urban centres to the same extent as hitherto, providing roads permit regular meetings of “locals” circles, clubs and parties.

Older people rate as more important perhaps than social activities, opportunities for conducting easily co-operative business organizations. The value of these local

bureaux, or "locals", aside from their use to members for the purposes of co-operative buying and marketing, should be judged also from the extent that they create better social relations between the various agricultural residents of a district.

## 10. Good Roads and Les Ententes Cordiales in Citizenship.

That good roads have a tendency to break down sectional prejudices, and to create mutual understanding and appreciation between families, clans, classes and races is shown by history from the time of the Roman invasion of Britain, down to the present. Many sections of the new world would have continued to be miniature replicas of portions of the old, had not roads led to freedom of movement and commingling of influences, tending to that gradual assimilation which is so desirable in welding a young nation together.

To make of every citizen of to-day and to-morrow, native and foreign-born, a good Canadian, morally, physically and intellectually par, at the same time, understanding and accepting our ideals, is an object of statercraft. For, upon the ability of Canadians to work together in the ends of common concern, and to consider the questions affecting the commonwealth from the view point of national, rather than sectional interest, will legislative union endure and national progress depend.

Large sections of Canada west of the Great Lakes are settled chiefly by people who have left former homes in Ontario and the Maritime Provinces. These people will always have an affectionate interest in the communities in the "East", formerly called home. While horizons have been widened, and new interests and associations formed, their inclinations to go back and review familiar scenes persist. Were it possible for the westerners to travel entirely over Canadian highways, using their own transport equipment, the journey would doubtless be made oftener, with advantage to all concerned. Better understanding of the points of view of both east and west must arise from the intimate associations formed by leisurely inter-provincial travel.

The interests of townspeople are more in common with those of country people than some of the former are prone to admit. When the people in the country are prosperous, it is largely because they have had ample supplies of sustenance, not alone for themselves, but also for the townspeople. Rural prosperity doubly promotes urban prosperity when in addition it means greater demands from the towns. At all events, appreciation of the points and respective problems of producer and consumer is heightened as incursions and excursions over the common roads increase.

## 11. Roads and Disease Prevention and Cure.

There is no single cause of dust formation that begins to equal the roads of the country under traffic. Earth, gravel and waterbound macadam roads, constituting until recent years practically 100 per cent of the road mileage in Canada, have all contributed to the volume of dust that rises into the air, daily in dry weather.

The following extracts from Rosenau's "Preventive Medicine and Hygiene", 1921 serve to indicate how inimical to health dust in the air we breathe, and particularly road dust is:—

"Dust is not only a nuisance, but under certain conditions is known to be prejudicial to health. Most of the dust is torn from the earth by winds . . . . Dust becomes injurious when excessive in amounts or when irritating in character, or when it contains injurious micro-organisms; the injury depends upon the constancy of its presence, and somewhat upon the susceptibility of the individual.



"Dust may act indirectly as a predisposing cause of many infections as well as directly irritating and inflaming the respiratory passages. The statement that dust opens the door to tuberculosis and other infections of the air passages, such as common colds, influenza, pneumonia, etc., can no longer be questioned. In certain cases the dust is retained as deposits in the lungs and neighbouring lymph glands without further damage. The lungs and bronchial glands of all adults are more or less discoloured from particles which are constantly inhaled.

"Winslow and Kligler report an average of 49,200,000 microbes per gram in New York street dust, and between 3,000,000 and 5,000,000 per gram in indoor dust. House dust is more harmful than outside dust not only because there is more of it, especially in badly ventilated and ill-kept rooms, but because it is more apt to contain living pathogenic bacteria.

"Street dust contains coal dust, metallic dust from the operation of trolley cars, material swept from houses and shaking rugs from windows, the grinding up of roadbeds by vehicles, ashes and other materials blown from barrels and teams. The bacteria are derived from dried fecal matter from horses and other animals, dried sputum, the soil, and a variety of other sources. Street dust may contain pathogenic organisms such as tubercule bacillus, many varieties of cocci, the colon bacillus, bacillus, aeroganes, capsulatus, and possibly, under special conditions, tetanus, malignant edema, and occasionally other pathogenic micro-organisms. Street dust therefore becomes more than a nuisance, for it is not only irritating, but may be a source of infection.

"When dust is violently stirred up, the quantity inhaled with attached micro-organisms has a real sanitary significance. Within recent years, however, we have learned that the air is not very much to be feared on account of the bacteria it may carry (everywhere present), except under occasional circumstances."

Unfortunately the occasional circumstances referred to are known too well by every resident of an unsurfaced or untreated busy street or road, particularly in the weeks in the spring and fall when high winds are prevailing.

The importance of dust-layers is usually based on the desire to be rid of a nuisance. That enough regard has been paid to the place road-dust has in creating conditions prejudicial to health is doubtful. While Tyndall may have overestimated the damages wrought by the bacteria of the air, his opinion that "all the havoc of war, ten times multiplied, would be evanescent if compared with the ravages due to atmospheric dust," can hardly be discounted.

Asphaltic road oils containing from 30 to 50 per cent asphalt are a popular means of laying dust, particularly on waterbound macadam roads. This material can be cheaply and effectively distributed from motor-driven pressure machines.

Other materials now being used in addition to water for dust-laying purposes are light tars, calcium chloride, and glutrin.

When from 0.2 to 0.3 gallon per square yard of bituminous dust-laying material is applied to the ordinary macadam road, the dust is usually successfully laid for some time.

Calcium chloride may be applied in powder form, or as a liquid solution. When this material is properly applied, at a rate of about 0.4 gallon to the square yard, results are good. In England, and in a few states, including Michigan, where it is obtained cheaply as a by-product in the manufacture of soda, the use of calcium

chloride is a regular part of the work of the road maintenance patrols. One advantage in the use of this material is that it is without odor, and it leaves no stain on vehicles.

Glutrin is a manufactured product made by concentrating to the desired consistency the waste liquid resulting from the making of woodpulp, according to the sulphide process. The use of this material in combination with semi-asphaltic oil or deliquescent salt, such as calcium chloride, is reported to give very satisfactory results, both in laying dust and in creating a bond between stone fragments.

The importance of building roads with materials incorporated in the surface in such a way as to prevent dust formation is now being recognized by highway engineers. The first cost of using permanent binders is found to be more than offset by the ultimate cost of providing dustless road service by means of annual applications of some form of dust-layer, or temporary binder, on the cheaper type of construction. To prevent wear is to prevent the formation of dust.

Hence consideration of the principles of both hygiene and economy suggests the advisability of care and caution in the selection of the materials to be used for surfacing purposes.

Good roads assist not only in preventing the spread of certain diseases, but also in increasing the zones of medical attention in effecting curative measures. Bad roads add to the difficulties of physicians in reaching patients.

Besides it is sometimes next to impossible to have patients requiring the special attention of a hospital transported from a rural part, on account of the rough and impassable condition of the roads.

There are fewer physicians and nurses in the rural districts than in the urban districts. This proportionate difference is due in part to the hardships of the country practice involved in being obliged to use all sorts of disagreeable roads. Vital statistics indicate that maternal and infantile mortality in Canada are both approximately 10 per cent greater in the country than in the city, showing an insufficient amount of medical knowledge and attention in the former. According to the Child Welfare Association of Montreal, Que., the infantile mortality rate is the best index of the social and moral conscience and sanitary status of a given community or nation. Canada's rate is 115; Ontario's, 95; that of the United States is 87.

That better rural roads will make the work of the medical and nursing professions in the country more attractive, and that the development of public health work for infants and the sick in the country will be promoted by better roads are therefore evident facts.

## 12. Good Roads and the Tourist Traffic.

The countries that tourists avoid are known for their poor means of internal transit; those that motor tourists forego the pleasure of travelling through, as a general rule, for their poor roads. The country that has improved its means of access has in these alone an attraction for the tourist.

A country with such variety, beauty and grandeur of natural attractions, such series of paradises for sportsmen that the Dominion of Canada possesses, owes to all within her borders and to all would-be tourists from without, every facility that will render such attractions more accessible. Natural scenery is a national resource when it is made approachable. But however grand and alluring a district may be to tourists, it is a waste of money to advertise attractions that may be reached only after discomforts and hardships on the roads leading thereto. Before the roads have been



reasonably improved, it is better from the standpoint of ultimate results to discourage tourists from visiting places known to be worth seeing.

The amount of travel between the provinces by motor has of late increased considerably. But the greatest source of tourist traffic to Canadian points is from the United States. Records kept by officials of the Department of Customs of the numbers of cars registered for touring purposes at the different ports of entry to Canada indicate that the number of people coming from the south to enjoy our scenic investitures and salubrious climate is steadily increasing. Since 1919, when Federal aid towards highway construction and improvement became effective, the number of motor tourists from the United States has nearly trebled.

The number of automobiles registered for six months' sojourn for the years 1919, 1920, and 1921 was, respectively, 1,202, 1,743 and 2,211; the number entering for thirty days or less was, respectively, 59,105, 91,718 and 127,321; and the number registering for twenty-four hours or less was, respectively, 177,646, 439,414, and 490,887. The large number of one-day entries is made up almost entirely of traffic between interurban points in the states of Michigan and New York, and the province of Ontario.

The average number of entries at the sixty-three ports along the border during 1921 was 2,056, taking no count of the one-day tourists. The number varied from 19,241 at Lacolle, Que., to three at Summerside, P.E.I. The differences in the tourist crop garnered by the several sections of the Dominion reflect highway conditions in the vicinity of the border ports. At points where the highways have recently been improved the increase in entries is notable, showing that good roads invite to the points of interest accessible.

Some indication of the trend of motor transport towards long-distance travel is seen in the fact that thirty-eight different states were represented in the grand total of motor tourists entering British Columbia last year from the south. Nine states bordering on the Atlantic Ocean from Florida to Massachusetts sent fifty-seven motor vehicular parties to British Columbia to visit the Canadian Alps and other natural attractions in that province.

Assuming that motor tourists entering Canada for six months remain on an average half time, for one month, full time, and that the occupants of each vehicle would make outlays daily of \$20, the value of this crop to Canada annually based upon the record for 1921 is \$90,000,000 in round figures.

The cultivation of the tourist industry is desirable for the following reasons:—

- (1) Tourists leave usually large sums in the country visited;
- (2) The tourists of to-day may, and often do, become settlers of to-morrow;
- (3) Experience has abundantly shown that international trade and commerce are largely increased, as a consequence of foreign tourist traffic; and,
- (4) The demands of the tourist industry help other industries.

### 13. Improved Roads and the Automobile Transport Industry.

The expansion of the automobile manufacturing industry in Canada has been marked in the last few years. The grand total value of automobiles, supplies, accessories and repair parts manufactured in this country increased from \$101,196,706 in 1919 to \$137,420,351 in 1920. The capital investment necessary in the production of these goods amounted in 1920 to \$89,183,306, an increase of 57 per cent over the year preceding. Over 14,500 persons were engaged in the making of these products,

and this group of industrially employed earned nearly \$23,500,000 in 1920. There are in Canada seventeen motor vehicle manufacturing plants of which ten make passenger vehicles and seven make trucks; and the motor vehicle supply plants number in all sixty-two. It is said that no less than eighty-five different occupational activities or classifications of skilled labour are necessary in the assembling and completion of one motor vehicle. The making of 94,000 passenger and commercial motor vehicles in Canada in 1920 therefore helped largely to increase the skill as well as the pleasure and profit of a large group of our citizens.

But to the above total of persons dependent upon the automotive industries should be added automobile dealers and their employees. The Automotive Industries Association of Canada report that there were in 1920 5,522 automobile dealers employing 43,094 persons, to whom \$56,022,200 were paid in wages. Public garages, repair depots, accessory supply stores, and gasoline stations swell the number, so that the employed and their dependents concerned with the manufacture, sale and service of motor vehicles in Canada total approximately a half-million persons.

The development of the automotive industries is closely related to the development of motor routes and to an increase of mileages of improved roads in every province.

As far as the law is concerned, automobiles have an equal right with other vehicles to the use of the highway, and this fact now imposes the responsibility upon road authorities of providing road surfaces correspondingly as sufficient as were the improved roads for the vehicle of the day before the advent of the automobile. Huddy states in "On Automobiles": Where a statute provides that the highways shall be kept in a reasonably safe condition for travellers, with horses, teams and carriages, the word "carriages", is construed to include motor-cars or automobiles." Again, "A failure to conform the highways to the changed methods of travel within a reasonable time, justifies a finding of negligence," on the part of municipal, provincial or other responsible road authority.

#### 14. Improved Roads and Accident Prevention.

Accidents on the public highways are commonly due to one or more of the following causes: excessive speed, inebriated condition of experienced operators, inexperienced operation, faulty lighting on vehicles or the road, faulty sight-lines and the condition of the road. For the first four of these enumerated causes, operators are responsible, and subject to the regulations and penalties prescribed in provincial statutes. But for the last two, namely, faulty sight-lines and road conditions, road authorities are responsible.

Poor sight-lines may be due to turns and twists in the road that follow the meanderings of a stream, or have taken the course of a sometime animal runway. Where trees or shrubbery has grown up at the bend of the road, the difficulty of seeing what is ahead is increased. Improvement of any road includes consideration of the best means of correcting faulty lines of sight, and the taking of all means possible to remove, eliminate or remedy natural obstacles to clear vision on the road.

Sometimes the only course open to the highway engineer is to recommend a new location entirely for the road between certain points. The importance of having proper surveys for all roads which will be required to sustain heavy traffic of fast-moving motor vehicles, and of paying particular regard in such work to the suitability of a given location from the standpoint of sight-lines is being recognized more and more.



Perhaps more accidents on the road have been caused by the condition of the road than from all other causes combined. The features of a road that lead to accidents are commonly, narrow grades, excessive crowns, slippery surfaces, pot-holes or sunken depressions, weak, narrow structures, and irregular improvements.

All primary roads are expected to provide for two-way traffic. For double traffic roads, modern practice calls for paved surfaces at least 18 feet in width, with two shoulders at least 3 feet in width each.

Many roads have been built for the use of animal-drawn vehicles with higher crowns than are desirable for automotive traffic. The amount of swaying that may arise from any cause on a road makes little difference to a buggy or wagon, but owing to the weight of motor vehicles and the sensitiveness of their steering mechanisms, swaying on a road with high crown is apt to lead to an accident with the motor car. Where the road surfaces have been wetted, high crowns are quite dangerous. The amount of crown required depends of course upon the character of the surfacing, and attention paid to drainage methods; but the tendency now is to reduce grades to about one-half-inch to the foot on the bases of the durable types of pavement.

Proper regard for the reasonable expectations of present-day highway traffic will remove most of the conditions on the road contributory to accidents.

However a word of caution might be sounded to those motorists who may be inclined to look for too much by way of long stretches of uniformly improved roads. Cases there have been of drivers of powerful machines attaining a high speed over a recently improved highway, and then coming suddenly to a bridge approach, for example, striking some obstacle, and having their vehicle overturned, with more or less serious consequences. As yet, most provinces have been able to provide improved surfaces for but short stretches outside of the larger centres. This fact is but another reason why each responsible authority may properly be expected to erect temporary signs of warning and direction, as the road is being built, so as to guide and warn foreign traffic particularly.

## 15. Roads in Relation to the Value of a Country's Citizens.

The march of civilization has been rapid when and where facilities for transportation have advanced.

Equality of opportunity, the unfolding of personal resources, and the enjoyment of a full intellectual life are all denied many citizens of a province who are obliged to use roads that discourage attendances at public and high schools, churches and social gatherings.

A high-class rural citizenship is impossible where the educative influences provided by organized associations usually found in towns are not brought within the reach of every farmer's family. Hence gradually good roads are coming to be regarded as indispensable to general welfare of the community, the province, the Dominion.

Accordingly, the federal, provincial and municipal authorities are now co-operating in an endeavour to make in Canada a general system of improved roads, stamping the nation as one in which civilization flourishes and prosperity is encouraged.

## COMPARATIVE STATISTICS OF MILEAGES BY PROVINCES AS AT JANUARY 1, 1922

Province	Total Mileage in	Per cent Very Fair to Good	Persons in per Mile	Area in Sq. Miles per Mile of Road	Mileages under Control of			
					Province	Counties	Townships	Urban Municipalities
Alberta.....	88,500	3	7	2.9	2,000 approx.			
British Columbia..	15,424	27	34	23	15,126 ††			86,500
Manitoba.....	68,000	6	9	4		††	††	††
New Brunswick.....	13,547	12	28	2	13,547			
Nova Scotia.....	15,188	8	26	1.4	15,188			
Ontario.....	64,198	18	45	6	1,812		40,181	
Prince Edward Island.	3,650	5	24	.6	11,850**	1,697 Class A*		
Quebec.....	43,877	9	54	16	3,650	7,621 Class B*	43,437	
Saskatchewan.....	135,000	4	6	1.8		††	††	††
Total in Canada.....	447,384†	8	20	5				

\*\* Northern Development and Colonization Roads in Northern Ontario.

\* Provincial-County Highways receiving a subsidy of 60%, Class A.

† County-Township Highways receiving a subsidy of 40%, Class B.

†† The registration of motor vehicles in Canada in 1921 was 463,848, or slightly in excess of one vehicle per mile of road.

††† Excepting in unorganized territory, all under control of rural municipalities.



Halifax, N.S.	Hamilton, Ont.	Kingston, Ont.	London, Ont.	Montreal, Que.	Muskoka, Ont.	Niagara Falls, Ont.	North Bay, Ont.	Ottawa, Ont.	Owen Sound, Ont.	Peterboro, Ont.	Quebec.	Regina, Sask.	St. John, N.B.	St. John's, Que.	St. Thomas, Ont.	Sault Ste. Marie.	Sherbrooke, Que.	Three Rivers	Toronto, Ont.	Vancouver, B.C.	Windsor, Ont.	Winnipeg, Man.
1314	1125	1390	942	1387	1356	1306	1054	1397	1204	779	2683	200	972	1396	1564	912	847	1275	3828	1500	2354	Halifax, N.S.
	202	76	372	123	44	237	300	159	116	546	1618	1114	402	83	495	473	467	39	2763	187	1289	Hamilton, Ont.
		278	163	206	244	278	118	161	113	335	1659	905	193	284	536	264	258	163	2804	387	1330	Kingston.
			448	199	119	313	376	141	192	620	1694	1190	478	15	571	549	543	115	2839	111	1365	London.
				445	414	364	112	455	262	172	1741	742	30	454	622	101	95	333	2886	558	1416	Montreal, Que.
					167	115	266	180	93	619	1496	1187	475	206	376	546	540	112	2641	310	1167	Muskoka, Ont.
						281	342	203	160	586	1662	1156	444	115	539	515	509	81	2807	226	1333	Niagara Falls, Ont.
						244	294	207	528	1381	1106	394	320	258	465	459	227	2526	424	1052		North Bay, Ont.
							383	183	284	1625	854	142	382	502	213	207	261	2770	486	1296		Ottawa, Ont.
								199	627	1675	1197	485	156	240	556	550	122	2820	252	1346		Owen Sound, Ont.
									434	1588	1004	292	198	465	363	357	77	2733	301	1259		Peterboro, Ont.
										1913	579	159	628	786	143	77	507	3058	730	1588		Quebec.
											2483	1771	1701	1123	1842	1836	1608	1145	1805	357		Regina, Sask.
												772	1196	1364	712	647	1075	3628	1300	2158		St. John, N.B.
													484	652	78	125	363	2916	588	1446		St. John's, Que.
														578	555	549	121	2846	111	1372		St. Thomas, Ont.
															723	717	485	2268	320	794		Sault St. Marie.
																93	434	2987	659	1517		Sherbrooke, Que.
																	428	2981	653	1511		Three Rivers, Que.
																		2753	224	1279		Toronto, Ont.
																			2950	1470		Vancouver, B.C.
																				1476		Windsor, Ont.
																						Winnipeg, Man.

## CANADIAN HIGHWAYS AND ROADS

TABLE OF DISTANCES (In English Statute Miles.)

COMPARATIVE STATISTICS OF MILEAGES BY PROVINCES AS AT JANUARY 1, 1922

STATISTICS OF MILEAGES BY PROVINCES AS AT JANUARY 1, 1922  
BY THE BUREAU OF THE CENSUS





